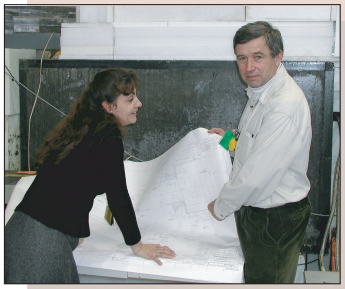
Instrument Highlight — Los Alamos Neutron Science Center

Inelastic Cold Neutron Spectroscopy (IN500)

Reactor-based neutron-scattering instruments currently deliver the highest performance needed for measurement techniques like cold neutron spectroscopy for the study of time and length scales at the boundary of microscopic and mesoscopic domains—so important for soft and complex matter. The next critical challenge in neutron science will be to pave the way for decisive advances in reactor-specific areas using spallation technology instead. The IN500 project at the Los Alamos Neutron Science Center will meet this challenge by developing and implementing a set of novel techniques in time-of-flight cold-neutron spectroscopy, including the use of high-intensity moderators, an optimally adjustable pulse-repetition rate, resolution and line shape, and enhanced beam delivery to the sample. Experiments of this type at the Manuel Lujan Jr. Neutron Scattering Center will benefit greatly from the newly installed coupled moderators, which currently provide the highest cold-beam intensities yet achieved at a spallation source.

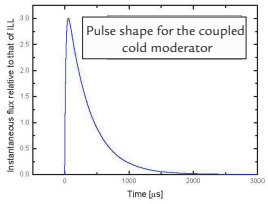
Margarita Russina, 505-667-8841, 505-665-2676 (fax), russina@lanl.gov
Ferenc Mezei, 505-667-7633, 505-665-2676 (fax), mezei@lanl.gov



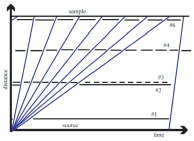
◀ Margarita Russina and Ferenc Mezei review blueprints for the new IN500 instrument.

Innovations

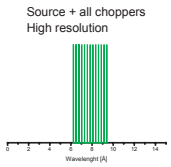
• Coupled moderators
– offer 5-7 times higher time average flux than the currently used decoupled moderators



• Repetition Rate Multiplication Principle
– use of a set of monochromatic pulses from each source pulse, instead of a single one

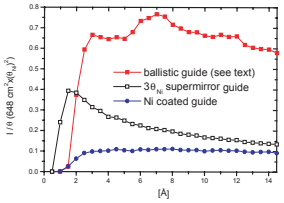


Time-distance diagram of IN500 spectrometer

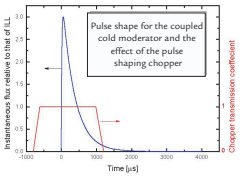


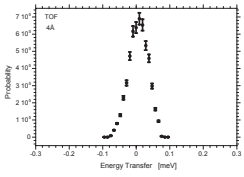
Calculated transmission at the sample position

• Low Loss Ballistic Neutron Guide
—Absorption in guides leads to losses during reflections
—To reduce losses: reduce the number of reflections:
– a large cross section Ni guide transports neutrons over most of the distance
– supermirror diverging guide ensures full illumination
– supermirror converging guide compresses the beam



• Pulse tailoring by phased disc chopper
– phased to cut the trailing edge of the source pulse in an adjustable manner
– adjustable resolution to optimize intensity for each experiment





IN500 Specifications

Moderator	Coupled liquid H_2, FP13
Moderator-sample distance	63 m
Sample-detector distance	3 m
Wavelength definition choppers	at 7 m, 20 Hz at 31.5m, 20 Hz
Resolution definition/ pulse-shaping choppers	at 31.35 m, 480 Hz (counter-rotating discs) at 62.5 m, 240 Hz (counter-rotating discs)
Pulse-filtering chopper	at 46.87 m, 320 Hz (single disc)
Ballistic guide	starts at 1.2 m, 61.3 m long
Detectors	10 m^2, pixel at 2 x 2 cm^2
Incoming wavelength range	2-20 Å
Resolution	adjustable, e.g.15-50 μeV at 7 Å incoming wavelength